

# On Pleurobranchomorpha from Italian Seas (Mollusca: Opisthobranchia)

by

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*Abstract.* Ten species of pleurobranchomorph opisthobranchs are reported from Italian waters, with special reference to the diets of the animals and the structure of the radular teeth and jaw platelets.

## INTRODUCTION

IN THE MEDITERRANEAN SEA the order Pleurobranchomorpha is represented by a small number of species, some widely distributed and well known, others uncommon and plagued by problems of taxonomy. Recent reports have come from widely separated localities within the Mediterranean: Villefranche-sur-mer (HAEFELFINGER, 1960), Marseille (VICENTE, 1967), Tuscany (SORDI, 1969), Costa Brava (ROS, 1975), Israel (BARASH & DANIN, 1971, 1977), and Gulf of Taranto (PERRONE, 1983). Although some mention of the order was made in a preliminary communication by SCHMEKEL (1968), they were omitted from consideration in the recent compendium *Opisthobranchia des Mittelmeeres* (SCHMEKEL & PORTMANN, 1982).

While studying opisthobranch samples from Italian seas, 10 species of Pleurobranchomorpha were collected, mostly by diving on hard substrata to a depth of 50 m. Particular attention was paid to the radulae, jaws, and diets of the species collected.

## PLEUROBRANCHOMORPHA

*Pleurobranchaea meckeli* Leue, 1813

**Material collected:** Ligurian Sea: Gulf of Genoa (August 1978, at 50 m depth); Gulf of Marconi (August-September 1982, on sandy and muddy bottoms from 40 to 90 m).

**Description:** This large (maximally 15 cm in length) and common species (Figure 3) has a broad oral veil, blunt rhinophores, and a large gill. The back is covered by a mottled brown and yellow pattern. A shell is lacking. The radular formula is 50-60 × 65(55).1.(55)65. The rachidian tooth is not always visible and can fall out of the preparation as reported for *Pleurobranchaea maculata* by WILLAN (1983). The other teeth are long and bicuspidate as

shown by PRUVOT-FOL (1954). The jaw platelets are changeable in length and breadth: they cannot be utilized for separation of species (MARCUS & GOSLINER, 1984). The large gill bears 28-30 pinnae.

**Diet:** The diet is variable and consists of vegetable debris, polychaetes (*Eteone* [*Mysta*] *picta*, *Phyllodoce* sp.), amphipods (mainly *Pseudoprotella phasma* and some *Photis longicaudata*), nudibranchs (Facelinidae), colonial ascidians, turbellarians, nemertines, and nematodes. In one specimen, an ectoparasitic isopod (*Meinertia oestroides*) was found near the genital apertures.

**Discussion:** Recently MARCUS & GOSLINER (1984) described two new Mediterranean species (*Pleurobranchaea notmec* and *Pleurobranchaea vaysierei*) and found, along the Israelian coast, an Atlantic species (*Pleurobranchaea inconspicua*). These three species are distinguished from *P. meckeli* by vaginal and penial characters: in my collection all specimens appear similar to the description of *P. meckeli*, with a long, looped cuticular penis and a long vagina.

This species has been recently recorded from France (HAEFELFINGER, 1960; VICENTE, 1967), Turkey (SWENNEN, 1961), Israel (BARASH & DANIN, 1971), Spain (ROS, 1975) and Italy (PERRONE, 1983).

*Pleurobranchus (Oscanius) membranaceus*  
(Montagu, 1803)

**Material collected:** Ligurian Sea: Gulf of Genoa, in the collection of the Zoological Institute of the University of Genoa, one specimen labeled "*Pleurobranchus* sp. ? 1886 Genoa." Tyrrhenian Sea: Gulf of Naples, Pozzuoli (June 1963, one specimen at 40 m depth, collected by L. Capocaccia).

**Description:** The mantle, pale brown with dark brown patches, bears many tubercles. Lengths of the two pre-

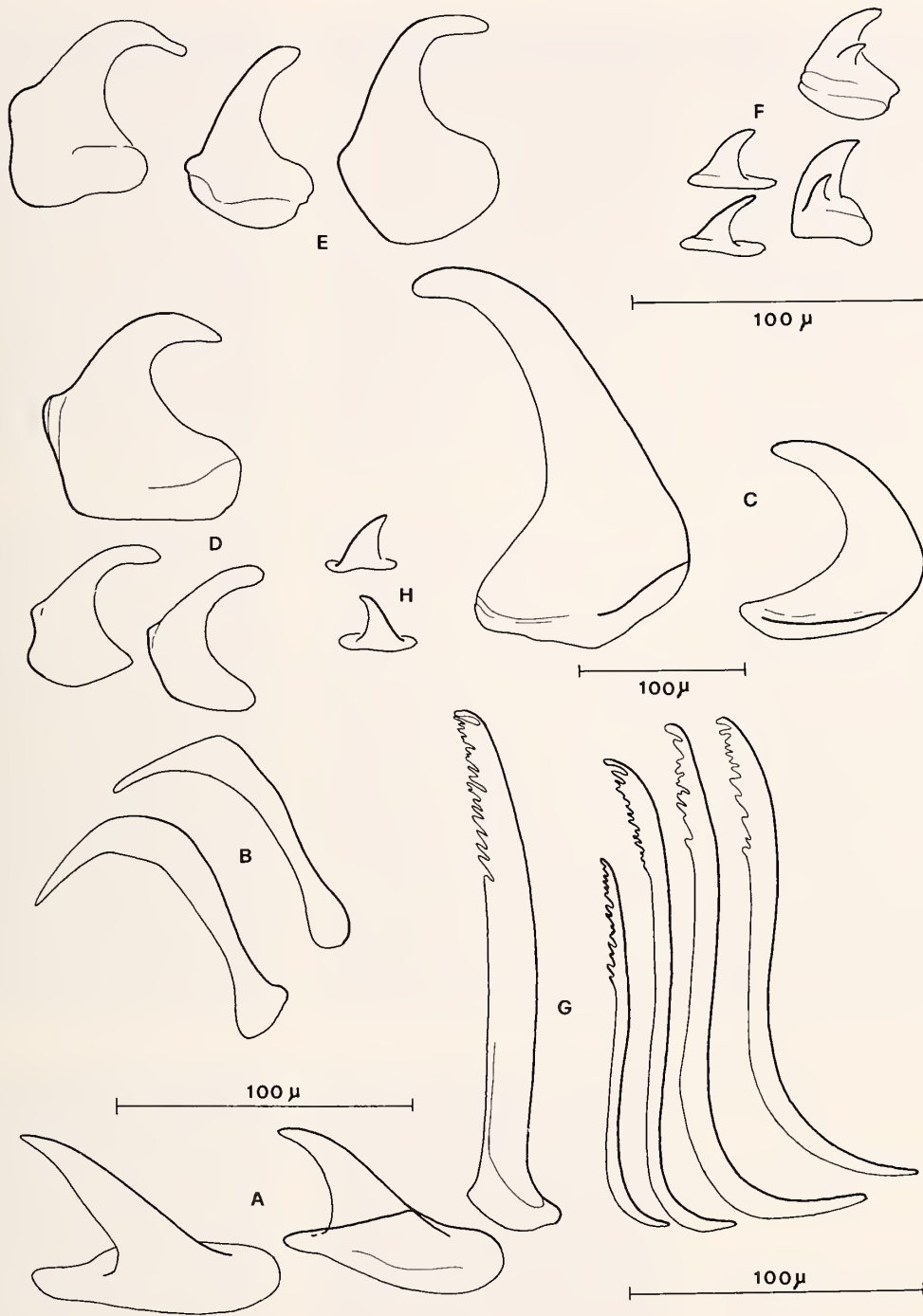


Figure 1

Teeth of Mediterranean Pleurobranchomorpha. A, *Pleurobranchus membranaceus* (inner lateral teeth); B, *Pleurobranchus membranaceus* (outer lateral teeth); C, *Pleurobranchus testudinarius*; D, *Berthella ocellata*; E, *Berthella* sp. 1; F, *Berthella* sp. 2; G, *Berthellina citrina*; H, *Berthella aurantiaca*.

served specimens are 30 mm (Genoa) and 35 mm (Pozzuoli). In the 30 mm long specimen, the dimensions of the shell are  $25 \times 17$  mm. The radular formula is  $36-45 \times 60(100).0.(100)60$ . The teeth nearest the rachis (Figure 1A) do not bear a subterminal spine, contrary to assertions by VAYSSIÈRE (1885), BERGH (1899), and THOMPSON (1976). The lateral teeth are longer and thinner (Figure 1B). The mandibular platelets (80–130  $\mu\text{m}$  long) bear 3 large denticles (Figure 2A). The gill rachis is tuberculate and bears from 24 to 26 pinnae. A pedal gland is present. There is a flap of flesh around the genital apertures, which are contiguous.

**Diet:** Nothing was found in the alimentary canals of the specimens studied.

**Discussion:** This species has been recently recorded from France (HAEFELFINGER, 1960; VICENTE, 1967) and Spain (ROS, 1975). It seems to be uncommon in Italian Seas; however, PERRONE (1983) collected several specimens in the Gulf of Taranto.

*Pleurobranchus (Susania) testudinarius*  
(Cantraine, 1840)

**Material collected:** Tuscany Archipelago: Isle of Elba (October 1982, one specimen from 45 m); Montecristo Isle (June 1983, two specimens from 40 m).

**Description:** This species (Figure 4) has a red ground color. The mantle is formed by large tubercles, which around their polygonal bases have a thin purple line. On top of the mantle there are two rows of larger tubercles. The Elba specimen was 15 cm in length, those from Montecristo smaller (12 cm). In these three specimens a shell was not found. The radular formula is  $220-250 \times 220(250).0.(250)220$ . The hooked teeth are simple and uniform (Figure 1C). The jaws of the largest specimen are 15 mm long, and their platelets, 370  $\mu\text{m}$  in length, have 2 or 3 lateral denticles (Figure 2B). The large tuberculate gill (45 mm long in the Elba specimen) bears 18–20 pinnae. A pedal gland is present.

**Diet:** Colonial ascidians (Didemnidae) were found in the stomachs, together with bivalves (*Musculus marmoratus*) and plant debris.

**Discussion:** This species lives on sandy to muddy bottoms, but recently ROS & GILI (1984) found it in an underwater cave at Majorca (Balearic Isles). Recent records come also from France (HAEFELFINGER, 1960), Italy (SCHMEKEL, 1968), Israel (BARASH & DANIN, 1971), and Spain (ROS, 1975).

*Berthella plumula* (Montagu, 1803)

**Material collected:** Ligurian Sea: Isle of Gallinara (August 1976, one specimen under a stone at 0.5 m depth).

**Description:** This specimen measured 5 mm in length and was light yellow in color. The mantle has reticulate markings as reported by THOMPSON (1976). The oval, white internal shell covers all the contracted body. The radular formula is  $40 \times 55.0.55$ . The teeth are simple hooks, while the mandibular platelets exhibit 2 or 3 lateral denticles on either side of the cusp (Figure 2E). The gill has 16 pinnae on either side of the smooth rachis.

**Diet:** No sponge spicules were found in the alimentary canal. This agrees with a diet of slime-sponges (e.g., *Oscarella lobularis*) as reported by DELALOI & TARDY (1976) or colonial tunicates.

**Discussion:** This species has been recorded in recent times from France (HAEFELFINGER, 1960), Italy (SCHMEKEL, 1968; PERRONE, 1983), and Israel (BARASH & DANIN, 1971).

*Berthella aurantiaca* (Risso, 1818)

**Material collected:** Tyrrhenian Sea: Gulf of Procchio, Isle of Elba (June 1978, one specimen in a meadow of *Posidonia oceanica* at 14 m depth).

**Description:** The specimen was 6 mm long and yellow in color. Through the skin of the smooth mantle calcareous deposits could be discerned. A large oral veil is present, and the white internal shell covers the entire contracted body. The radular formula is  $50 \times 60.0.60$ . In the preserved state, this species can be distinguished from *B. plumula* by its larger mandibular elements (Figure 2D), but the radular teeth do not differ significantly (Figure 1H). The gill has 18 pinnae on either side of the smooth rachis.

**Diet:** No sponge spicules were found in the alimentary canal.

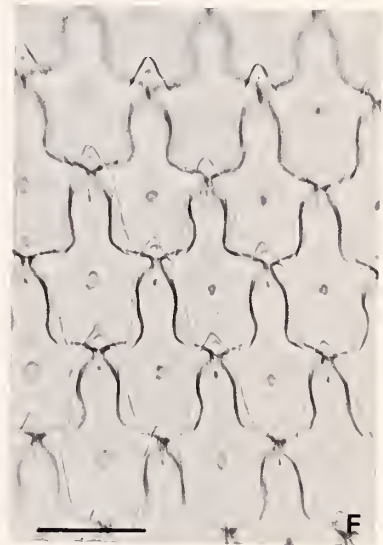
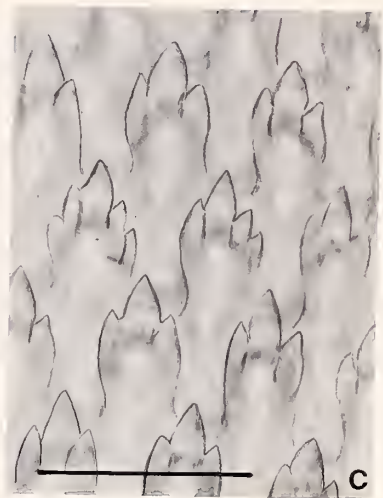
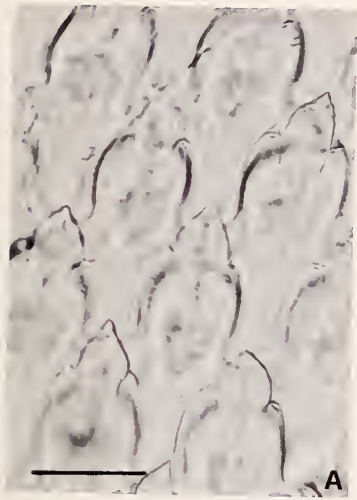
**Discussion:** Recent records have come from France (HAEFELFINGER, 1960), Italy (SCHMEKEL, 1968; SORDI, 1969; PERRONE, 1983), Yugoslavia (STARMÜHLNER, 1969), Israel (BARASH & DANIN, 1971), and Spain (ROS, 1975; ALTIMIRA *et al.*, 1981; ROS & GILI, 1984).

*Berthella ocellata* (Delle Chiaje, 1828)

**Material collected:** Tyrrhenian Sea: Gulf of Naples (May 1979, in the Mitigliano Cave on the Sorrentine Peninsula at 12 m depth).

Figure 2

Mandibular platelets of Mediterranean Pleurobranchomorpha (bar = 50  $\mu\text{m}$ ). A, *Pleurobranchus membranaceus*; B, *Pleurobranchus testudinarius*; C, *Berthella* sp. 2; D, *Berthella aurantiaca*; E, *Berthella plumula*; F, *Berthella* sp. 1; G, *Berthella ocellata*; H, *Berthellina citrina*.



**Description:** The ground color of this species is tan, and the mantle has many whitish spots (*ocelli*) surrounded by opaque white oval rings (MAZZARELLI, 1891). The specimen measured 18 mm in length and had a white oval internal shell, 4.5 mm long. The radular formula is  $60 \times 65.0.65$ . The teeth are squat and hook-shaped (Figure 1D). The mandibular elements are smooth (Figure 2G), which is unusual in this genus but has been reported also for *B. monterosati* (VAYSSIÈRE, 1885), a synonym. The gill has 15 pinnae on either side of the smooth rachis.

**Diet:** In the Mitigliano Cave, *Berthella ocellata* feeds upon sponges, e.g., *Plakina trilopha* and *Plakinastrella copiosa*.

**Discussion:** Recent records have come from Marseille (VICENTE, 1967), Tuscany (SORDI, 1969), and Costa Brava, Spain (ROS, 1975).

#### *Berthella* sp. 1

**Material collected:** Ligurian Sea: Paraggi, Portofino Promontory (June 1978, one specimen from 13 m depth, hard bottom).

**Description:** This specimen resembles *B. ocellata*, but the coloration is different: the brown mantle has only sparse white patches, which are not organized into *ocelli*. The body length is 20 mm, and the white, subtriangular shell is 7 mm long. The radular formula is  $85 \times 80.0.80$ ; the teeth are simple hooks, like those of other species of *Berthella* (Figure 1E). The mandibular elements are smooth (Figure 2F). The smooth rachis of the gill bears 18 pinnae.

**Diet:** Spicules of the sponge *Corticium candelabrum* were found in the alimentary canal.

#### *Berthella* sp. 2

**Material collected:** Ligurian Sea: off Alassio (May 1975, one specimen from 185 m, coll. G. Albertelli).

**Description:** The shape of this specimen, which was 9 mm long and had a smooth, yellow mantle, resembles that of *Berthellina citrina*. A large oval veil is present, and the internal shell is approximately  $\frac{1}{4}$  the body length. The radular formula is  $40 \times 35.0.35$ . Teeth from the central part of the radula bear an additional subterminal spine, as in *Berthella tupala* Marcus, 1957, and many species of *Pleurobranchus* (Figure 1F). The mandibular platelets generally have one or two very distinct denticles on either side of the cusp and are more like the elements of *Pleurobranchus membranaceus* than those of the other *Berthella* species (Figure 2C). The gill, lacking tubercles, has 20 pinnae on either side. An external penial sheath is present. The salivary glands are long and ribbon-shaped.

**Diet:** There were no sponge spicules in the alimentary canal of the specimen.

#### *Berthellina citrina* (Rüppell & Leuckart, 1828)

**Material collected:** Ligurian Sea: Paraggi, Portofino Promontory (July 1979, one specimen from 25 m depth, under a stone). Tyrrhenian Sea: Gulf of Naples (June 1979, June 1980, June 1981, many specimens in submarine caves along the sorrentine Peninsula).

**Description:** The color of this species is yellow-orange and it may be confused with *Berthella aurantiaca* on external features alone. However, the tooth-shape is unmistakable (Figure 1G). The oval shell is small and white; one specimen from Mitigliano Cave had no shell. The radular formula is  $45-80 \times 160(200).0.(200)160$ . The elongate teeth bear serrations on their posterior edge. (Figure 1G). The platelets are smooth (Figure 2H). The number of gill pinnae varies from 16 to 20 in specimens 6-11 mm in body length. A pedal gland is lacking.

**Diet:** Observations on the diet of *Berthellina citrina* have been published by CATTANEO (1982). In the present collection, the specimen from Paraggi contained spicules of the sponges *Hemimycale* sp. and *Batzella* sp.

**Discussion:** WILLAN (1983) discussed whether or not *Berthellina citrina* and *Berthellina engeli* Gardiner, 1936, are the same species. Here, they are considered synonyms, as did THOMPSON (1976). According to BURN (1962) these two species differ mainly in the shape of the jaw platelets, which are smooth in *B. engeli* and bear 1-3 indistinct lateral denticles in *B. citrina*. In the same paper, however, Burn reports the presence of smooth platelets in *B. citrina* from Australian waters: this is in agreement with THOMPSON's (1976) description of *B. citrina* from European waters.

Recent records of *Berthellina citrina* include localities in France (HAEFELFINGER, 1960), Italy (SCHMEKEL, 1968), and Israel (EALES, 1970; BARASH & DANIN, 1977).

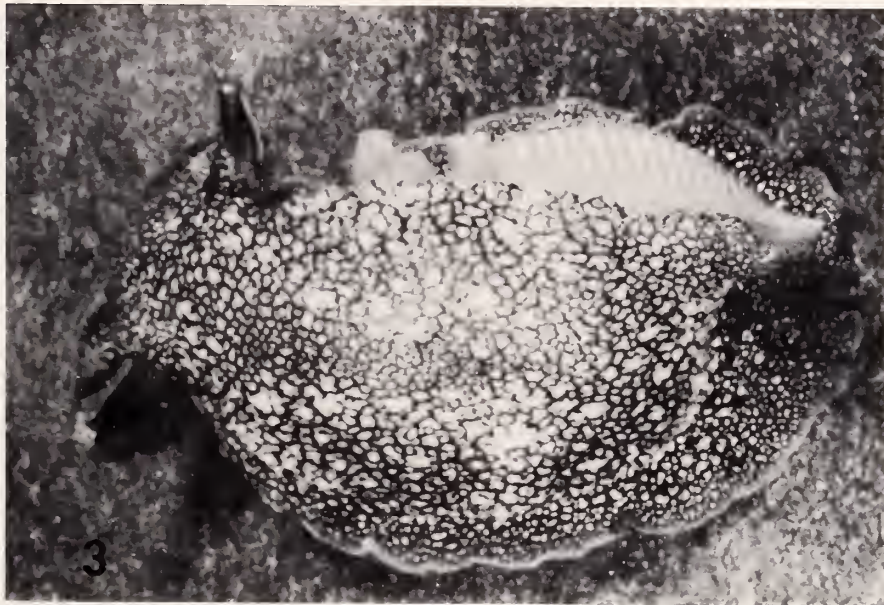
#### *Umbraculum mediterraneum* (Lamarck, 1812)

**Material collected:** Tyrrhenian Sea: Isle of Montecristo (July 1980; July 1982 in a submarine cave at 30 m depth). Sicily Channel: Isle of Linosa (August 1978 in a small cave at 4 m).

**Description:** This species, unmistakable with a flat external shell, is well described by MOQUIN-TANDON (1870) and PRUVOT-FOL (1954). The radular formula is up to  $150 \times 1000.0.1000$ . The teeth, numerous and all alike, are hook-shaped. In smaller specimens (length 30 mm) from the Isle of Montecristo, the gills are not present around the front of the body as in the larger individuals (length 85 mm).

**Diet:** The diet consists of several sponges: *Tethya citrina*, *Diplastrella unistellata*, *Jaspis johnstoni*, *Alectona millaris*, *Agelas* sp., *Aaptos aaptos*, and *Spirastrella cunctatrix*.

**Discussion:** This species is quite common in caves and in shaded habitats. Recent records of *Umbraculum* have come



Explanation of Figures 3 and 4

Figure 3. *Pleurobranchaea meckeli*, 10 cm length. Ligurian Sea, Genoa, on muddy bottom at 50 m depth.

Figure 4. *Pleurobranchus testudinarius*, 15 cm length. Tyrrhenian

Sea, Isle of Elba, on sandy bottom at 45 m depth. The rhinophores are on the left side. Photo by R. Pronzato.

from France (HAEFELFINGER, 1960; VICENTE, 1967), Turkey (SWENNEN, 1961), Italy (SCHMEKEL, 1968), Israel (BARASH & DANIN, 1971), and Spain (ROS, 1975).

CONCLUSIONS

If we exclude several species imperfectly described by FORBES (1844), PHILIPPI (1844), and VÉRANY (1846) and all considered *incertae sedis* by PRUVOT-FOL (1954), the

Pleurobranchomorpha present in the Mediterranean Sea are as follows:

Superfamily Pleurobranchacea

Family Pleurobranchaeidae

*Pleurobranchaea meckeli* Leue, 1813

*Pleurobranchaea inconspicua* Bergh, 1897

*Pleurobranchaea vayssierei* Marcus & Gosliner, 1984

*Pleurobranchaea notmec* Marcus & Gosliner, 1984

## Family Pleurobranchidae

*Pleurobranchus (Oscanius) membranaceus* (Montagu, 1803)

*Pleurobranchus (Susania) testudinarius* Cantraine, 1840

*Pleurobranchus forskali* (Rüppell & Leuckart, 1828)

*Berthella plumula* (Montagu, 1803)

*Berthella aurantiaca* (Risso, 1818)

*Berthella ocellata* (Delle Chiaje, 1828)

*Berthella stellata* (Risso, 1826)

*Berthella perforata* (Philippi, 1844)

*Berthella elongata* (Cantraine, 1835)

*Berthellina citrina* (Rüppell & Leuckart, 1828)

## Superfamily Umbraculacea

## Family Umbraculidae

*Umbraculum mediterraneum* (Lamarck, 1812)

## Family Tylodinidae

*Tyrodina perversa* (Gmelin, in L., 1791)

*Tyrodinella trinchesei* Mazzarelli, 1897

The list is probably incomplete because of the past nomenclatural confusion. Some of the taxonomic problems are, at present, insoluble, but progress continues to be made. *Berthella stellata*, for example, was recently validated by detailed re-description of Adriatic specimens by THOMPSON (1981), while MARCUS & GOSLINER (1984) provided an exhaustive review of the Pleurobranchaeidae. Unfortunately, many other problems persist. *Berthella elongata* was recorded by VICENTE (1967) from the Gulf of Marseille and by PERRONE (1983) from the Salentin coast of the Gulf of Taranto, but the specific validity seems to be uncertain because of the poorness of the descriptions. The status of *Berthella perforata* remains enigmatic also, and there is confusion between past records of *Berthella plumula*, *B. aurantiaca*, and *Berthellina citrina*. It is necessary to inspect the radula and jaws in order to differentiate between species of *Berthella* and *Berthellina*, and distinguishing between *B. aurantiaca* and *B. plumula* remains difficult, especially when the specimens have been preserved (TERRENI & CAMPANI, 1980). When alive, *B. plumula* can be seen to have conspicuous reticulate markings on the dorsal mantle. The description of *Gymnotoplax barashi* Marcus, 1977, was undoubtedly based in error upon a distorted specimen of *Pleurobranchus membranaceus*, as pointed out by WILLAN (1978). Although *Tyrodinella trinchesei* is listed here, PRUVOT-FOL & FISCHER-PIETTE (1934) and BERTSCH (1980) have raised justifiable doubts about its validity.

Two further notes on the records of pleurobranchomorphs warrant mention. First, *Tyrodina perversa* is a rare species, recently recorded from the Gulf of Naples (SCHMEKEL, 1968) and the Gulf of Taranto (PERRONE, 1983). In the Ligurian Sea it was photographed at 15 m depth off Portofino in October 1962 by Dr. G. Pulitzer-Finali. Second, *Pleurobranchus forskali* has been recorded in the eastern Mediterranean Sea (BARASH & DANIN, 1977) and it is an example of Lessepsian migration.

The observations reported here confirm that the Pleurobranchomorpha are carnivorous. Furthermore, those species that live on hard substrata show a more highly specific diet (usually species of sponge) than the more catholic species that live on soft bottoms.

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